TOPIC: INTRODUCTION TO POPULATION GROWTH MODELS

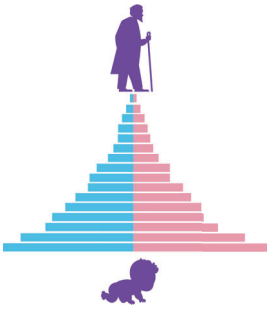
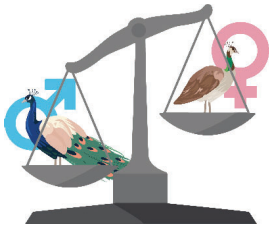
◆ **Population Growth Model:** mathematical tool used to _____ how a population's size will change over time.

- We will cover 3 population growth models:

1) _____ Model | **2) _____ Model** | **3) _____ Model**

Assumptions of Population Growth Models

◆ Population growth analyses are often simplified by making _____:

Closed Population (No immigration or emigration)	**Homogenous Environment**	**Ignore Age Structure**	**Ignore Sex Ratio**	**Ignore External Factors Affecting N**
				

NOTE: These assumptions offer _____ advantages & disadvantages to the population growth models.

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Population Growth Rate ($\frac{\Delta N}{\Delta t}$) vs. Per Capita Population Growth Rate (r)

- Recall: **Population Growth Rate ($\frac{\Delta N}{\Delta t}$)**: the overall change in population size (_____) over time (_____).
- **Per Capita Population Growth Rate** (____): the average population growth _____ _____.
  - Represents each individual's average contribution to overall population growth.

If a squirrel population has 1,000 individuals at the start of the year & 1,025 at the end of the year, what is $\frac{\Delta N}{\Delta t}$ & r?

Population Growth Rate ($\frac{\Delta N}{\Delta t}$)

$$\frac{\Delta N}{\Delta t} = \frac{\text{Change in Population Size}}{\text{Change in Time}}$$

The population growth in this time period was _____ squirrels per year.

Per Capita Population Growth Rate (r):

$$r = \frac{\text{Population Growth Rate } (\frac{\Delta N}{\Delta t})}{\text{Initial Population Size } (N_0)} = b - d$$

b = per capita **b**irth rate
d = per capita **d**eath rate

The *per capita* population growth in this time period was _____ squirrels per year per squirrel.

EXAMPLE

A population of 200 fish in an isolated pond experiences a per capita birth rate (b) of 0.3 and a per capita death rate (d) of 0.1 in a month. Calculate the population growth rate and intrinsic rate of increase (r).

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PRACTICE

An island has a population of 10,000 rabbits at the beginning of the year. During the year, there were 400 births and 150 deaths. Calculate the population growth rate and the per capita population growth rate.

a) $\frac{\Delta N}{\Delta t}$ = 250 rabbits/year; r = 0.25 rabbits/year/rabbit.

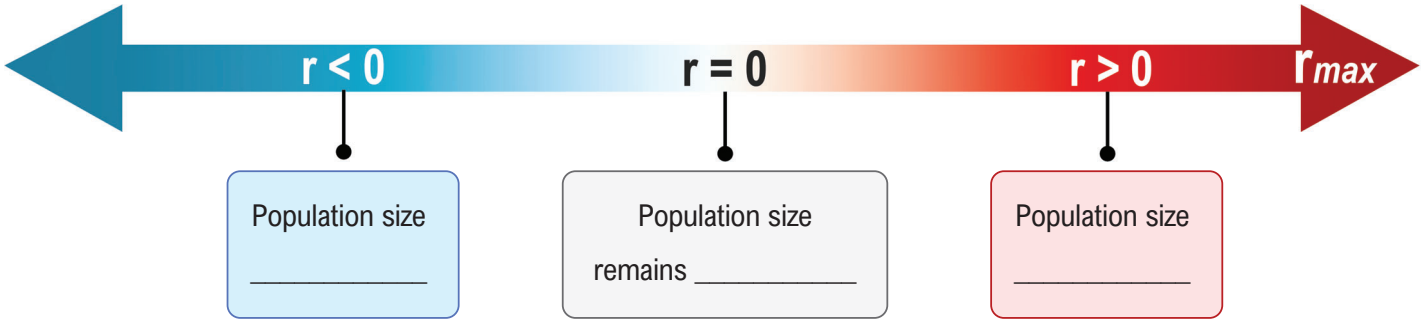
b) $\frac{\Delta N}{\Delta t}$ = 250 rabbits/year; r = 2.5 rabbits/year/rabbit.

c) $\frac{\Delta N}{\Delta t}$ = 250 rabbits/year; r = 0.025 rabbits/year/rabbit.

d) $\frac{\Delta N}{\Delta t}$ = 550 rabbits/year; r = 0.0025 rabbits/year/rabbit.

Population Growth Model Variable "r"

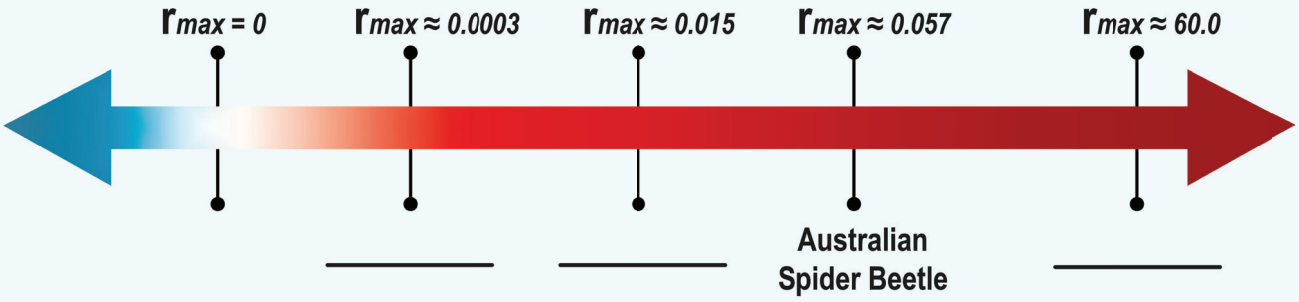
- The variable "____" appears in all 3 population growth models (linear, exponential, & logistic).
  - In linear growth model, **r** = population growth rate = $\frac{\Delta N}{\Delta t}$
  - In exponential & logistic growth models, **r** = _____ _____ population growth rate = $\frac{Population\ Growth\ Rate\ (\frac{\Delta N}{\Delta t})}{Initial\ Population\ Size\ (N_0)}$
    - $\mathbf{r_{max}}$: _____ per capita population growth rate for a species in _____ conditions.
- In all 3 population growth models, the value of "r" dictates how quickly population size changes over time:



EXAMPLE

Appropriately match each species with their corresponding r_{max} value (per capita, per day).

a) E. coli. b) Human. c) Brown Rat.



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EXAMPLE

A population of 289 wolves has 27 births and 9 deaths from 2023 to 2024. Calculate the per capita birth rate, per capita death rate, the per capita population growth rate, and the overall population growth rate.

PRACTICE

In which population growth models is the population growth dependent on the current population size?

a) Linear model. b) Exponential model. c) Logistic model. d) Exponential & logistic models.